Space Weather Technical Forecast

Issued on Wednesday, 12 June 2024 at 00:19 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares (R1-R2 radio blackouts) and minor solar radiation (S1) initially, this risk declining into the period.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity is Low with only C-class activity over the last 24hrs, peaking with a C9.1 flare at 11/0443 UTC from AR3697 around the southwest limb. There are currently seven sunspot regions on the visible disc, with six numbered and a small as yet unnumbered region developing in the southeast. AR3709 in the southeast is now the largest region. It consists of a larger leader spot surrounded by some smaller trailing spots, although recent growth has stalled. The remaining regions are mostly simple and stable with a couple of previous spots fading from view. Some magnetic looping observed in SDO imagery suggests a potential new region will rotate onto the southeast limb in the next 24 hours.

No Earth-directed CMEs have been observed in the past 24 hours. Recent Type II radio burst and significant field line opening on SDO imagery suggest a flare and likely CME from a region around the west limb.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, generally declined from a peak around 550 km/s early in the period towards current speeds of around 350 km/s. Density was below average throughout. The IMF (Interplanetary Magnetic Field), Bt, was initially moderate around 9nT but steadily fell back to weak levels. The north-south component, Bz, was also initially moderate, peaked at -9nT, but has also dropped back to weak levels, with only brief negative intervals. The phi angle initially varied between positive and negative but became predominantly positive (Away from the Sun) from around 11/0800 UTC. Geomagnetic activity was initially Unsettled to Active (Kp3-4) due to CME influence but declined to become Quiet (Kp1-2).

Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 continued to remain below the S1/Minor radiation storm level but remained above background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at background levels, with the associated 24-hour fluence well below Active. Observed fluence at 12/0000 UTC was 1.09e6 integrated pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 in the short term. The flare risk reduces into the period pending further developments.

Solar Wind / Geomagnetic Activity: Solar wind speeds are now at background levels as recent CME influence continues to wane and are currently expected to remain so through much of the

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period.

Overall, geomagnetic activity is likely to be mostly Quiet, with a chance of Unsettled to Active intervals into day 3 and day 4 (14-15 Jun) due to any weak high speed stream influence.

Energetic Particles / Solar Radiation: High energy proton flux is now below S1/Minor radiation storm levels after the recent enhancement. A chance of further S1 enhancement is maintained for day 1 (12 Jun), before the risk eases into the period.

High energy electron flux is forecast to persist at predominantly background levels, and the associated 24-hour fluence expected to remain below the Active threshold.

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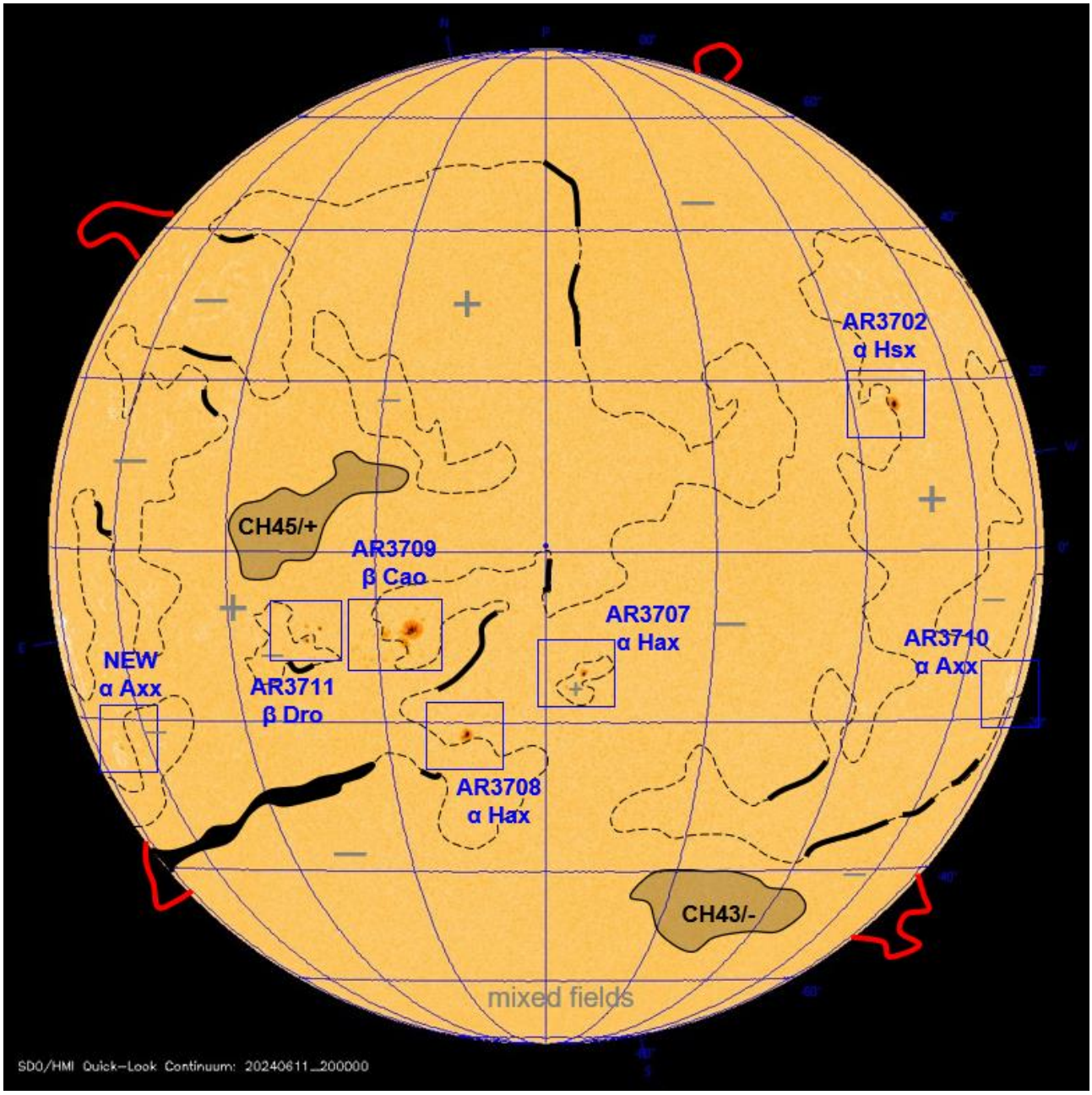
Figure 1. Solar Analysis Valid 11/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

No Earth-directed CMEs currently feature in the forecast.

Solar wind speeds are now at background levels as recent CME influence continues to wane and are currently expected to remain so through much of the period. Slight coronal hole influence is possible into days 3 and 4 (14-15 Jun) however, and this may see winds become slight elevated at times but this is expected to give only a limited geomagnetic response.

Overall, geomagnetic activity is likely to be mostly Quiet, with a chance of Unsettled to Active intervals into day 3 and day 4 (14-15 Jun) due to any weak high speed stream influence.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

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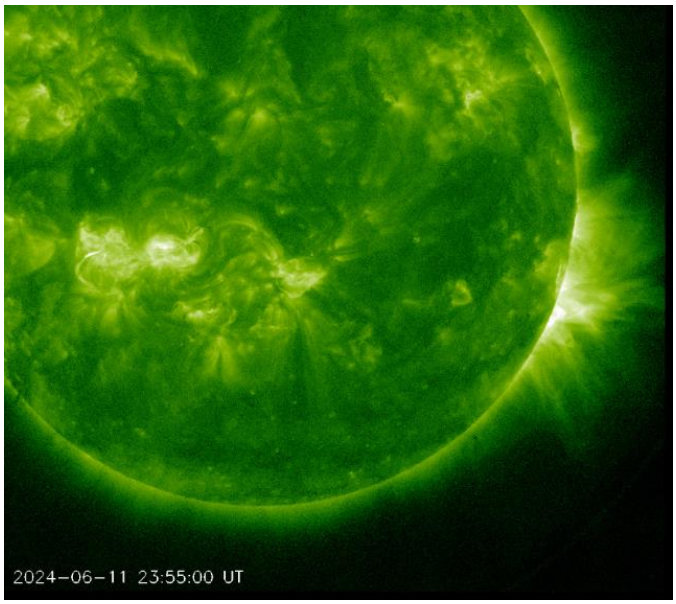
Radio Blackouts - X-Ray Flares:
There are currently seven sunspot regions on the visible disc, with one unnumbered region in the southeast. The most active region over the past day has likely been AR3697, but this has now rotated off the visible disc. However this region continues to contribute somewhat to the flare risk into day 1 (12 Jun) although this fairly quickly reducing. AR3709 in the southeast is now the largest region. It consists of a larger leader spot surrounded by some smaller trailing spots, although recent growth has stalled. The remaining regions are mostly simple and stable. Magnetic looping observed in SDO imagery suggests a potential new region will rotate onto the southeast limb in the next 24 hours although far-side sounding data suggests no regions of significant size are expected.

There is a chance of isolated M-class flares, with just a slight chance of X-flares initially, most probably from the declining AR3697 in the short term. The flare risk reduces into the period pending further developments.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	30	25	20	20
Very Active	R3 to R5 X Class	No	10	5	1	1

Figure 2: Recent SDO/AIA 94 imagery showing continued brightening from around the southwest limb associated with AR3697.



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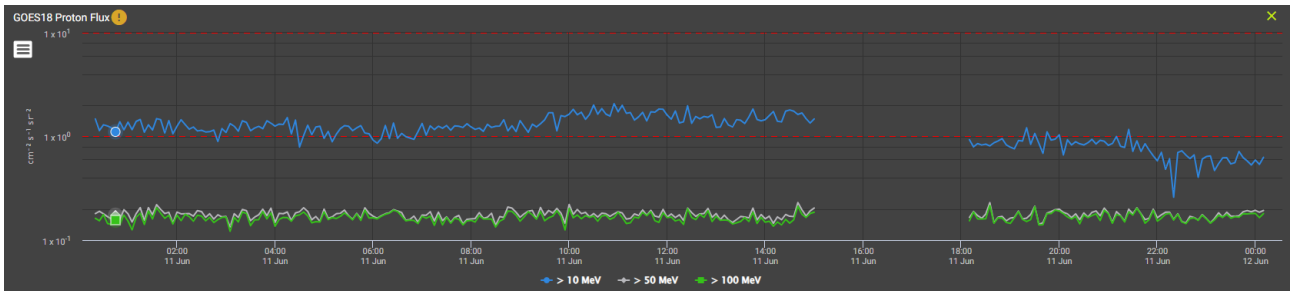
Solar Radiation Storms - (High Energy Protons):

Proton flux levels have continued to decline below S1 levels in recent hours, although further flaring from AR3697 continues to present a risk of Proton enhancements in the short term. ACE EPAM output showing some sign of low energy Proton enhancement ongoing following a likely CME from this region around 11/2250 UTC. It remains to be seen if this will translate to rises in GOES 18 Proton Flux in the coming hours but for now a chance of further S1 enhancement is maintained for day 1 (12 Jun), before the risk eases into the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	30	5	5	5
Very Active	**≥ S3 ***	No	5	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 3: Latest 24hr GOES18 Proton Flux trace.



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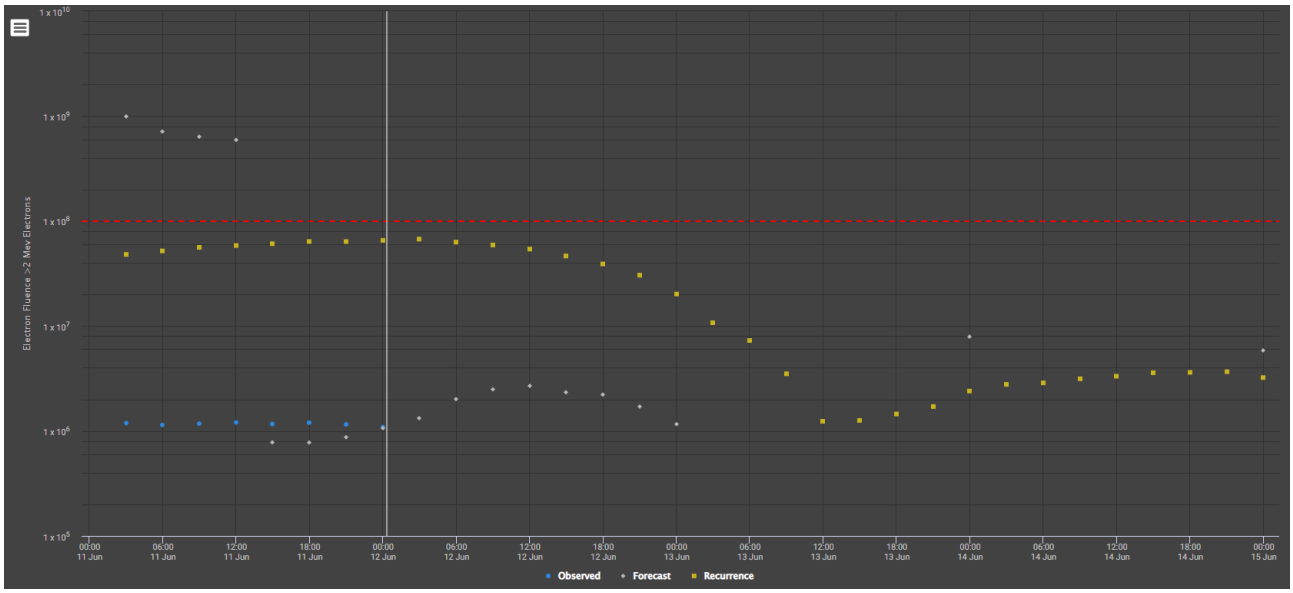
High Energy Electrons Event (≥ 2MeV):
The high energy electron flux is expected to persist at generally background levels for much of this period with limited significant sources of enhancement expected. Some diurnal Moderate flux values becoming likely into the period however.

MOSWOC REFM output has been erroneously forecasting fluence above the Active (1e8 integrated pfu) level through the 11 Jun, but more recent output sees fluence expected to remain below Active throughout and is viewed as providing better guidance.

GEO Electron Environment	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	1	1
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: Latest MOSWOC REFM model output.



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